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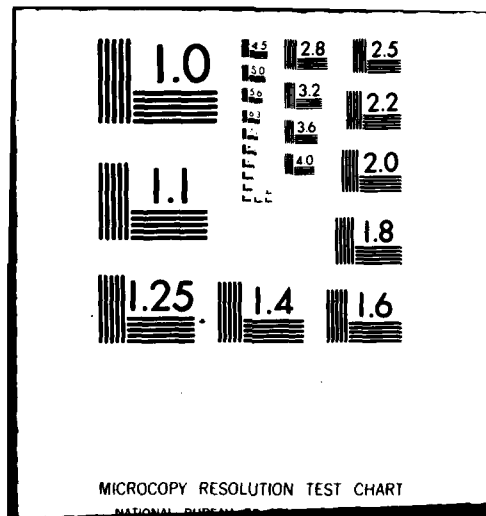
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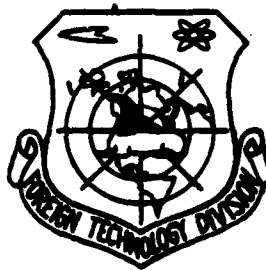


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by

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CURRENT PROBLEMS OF TOXICOLOGY IN THE SYSTEM OF GENERAL
NATIONAL DEFENSE

by

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(Received June 7, 1977)

The present paper deals with the principal trends in the development of modern chemical warfare agents and describes the most important of these. Besides the tactical aspects, the principal guidelines regarding first aid and health care protection are discussed in the light of a possible massive chemical attack using these chemical agents.

The organization of medical protection and defense against chemical warfare is described in detail within the concept of general national defense, such as ought to be implemented in all the areas and regions of our country.

MODERN CHEMICAL WARFARE AGENTS

Modern chemical warfare agents, which in recent years have been undergoing continuous development, represent a real danger in the possible future military conflicts. This is attested to by the great quantities of chemical warfare agents which have been produced and stored and by the large selection of chemical ammunition, as well as by the equipment and devices used to launch them (such as, scattering installations, cassette bombs, rocket projectiles, etc.) (1, 2). The tactical and technological principles of each and every chemical warfare agent have been developed in detail and their respective toxicological effects have been estimated. The so-called "binary" chemical warfare agents have also been developed, being that kind of chemical munition where there are present two nontoxic

reagents which are separated from one another and which interact at the instant of launching such munition yielding a lethal nerve gas (2).

Such a development of chemical warfare agents imposes awesome new problems to the country's defense forces, and in particular to the health care service, both in regard to protection from these chemical warfare agents used for massive destruction and disablement of people as in removing the consequences of the toxic effects and in taking care of those hurt.

Modern poisonous gases which enter the composition of chemical warfare agents

The first place in the poisonous gases group is, of course, occupied by the nerve poisonous gases. These are Sarin, Soman, Tabun, and VX. These highly toxic organophosphoric cholinesterase inhibitors are present in all kinds of chemical warfare agents and are the basic lethal poisonous gases. Whereas the first three are intended primarily for inhalation poisoning of people, the VX is intended primarily for percutaneous contamination. The tactical and technological properties of these gases are completely defined. Known are the probable lethal concentrations for man and the extent of losses relative to the technical and medical protection has been evaluated. Likewise, the principles of taking care of the poisoned victims have been worked out, even though a number of problems remains as yet unsolved relative to the therapeutical aspects, particularly for poisoning by Soman and for certain ways of contamination.

Other lethal gases - perhaps less salient - can also be found in chemical warfare arsenals. These are first of all blister gases

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(sulfur and nitrogen iperite) in new forms, and then common poisonous gases of the cyanic acid type and asphyxiating gases (phosgene and diphosgene). Out of the mentioned poisonous gases one must specially emphasize the iperites due to their long-term action and very peculiar tactical and technological characteristics.

The other contemporary group of war gases consists of poisonous gases used for temporary disablement of people in the performance of their combat functions. These are nonlethal gases producing temporary disablement by toxically acting upon individual somatic or psychic functions.

A special group of poisonous gases for temporary disablement consists of irritants or exhaustion gases, which irritate the skin and accessible mucous membranes. Besides the previously known tear gas and irritants of the chloroacetophenon or brombenzylcyanide type, the following modern war agents are also included in this group:

1. CS (orthochlorobenzylidene malononitrile) has been used in the Vietnam War by the American Army in several forms. This gas is predominantly a lacrimator and its toxicological properties are well defined (3,4).

2. CR (dibenzo /b/ f-1, 4-oxazepine) has better physical properties than CS, is less toxic and acts primarily as an irritant (3, 4).

3. BZ (3-chinuclidine benzylate) is a psychochemical poison causing the state of acute toxic delirium-confusional psychosis, in which there predominate neurovegetative disturbances, perception disturbances (hallucinations, illusions, etc.), and to a lesser degree disturbances in emotions, attention, and thinking (5). The mechanism of the action of BZ poison, which is relatively slightly toxic, is not known. This poison is used for contamination by inhalation.

4. Staphylococcic enterotoxin (PG-poison) is a poisonous gas which

causes temporary disablement of people by paralysis of individual somatic functions.

Standardized as a war gas is also the botulinus toxin (type A). This is a highly toxic poison whose application represents a special hazard due to the fact that the specific serotherapy is applied just after the clinical picture has been established which, of course, is without any great therapeutic effect.

First aid and treatment of those poisoned

The modern therapy for poisoning by nerve war gases may be systematized as specific (antidote) and symptomatic (nonspecific) therapy.

The specific therapy is represented by reactivators of inhibited cholinesterase, namely oximes. Nowadays, the following oximes are available and being used for treatment of poisoning by nerve gases, namely: PAM2-Cl (pralidoxime) and P2S (contrathion) from the group of monopyridinium oximes, and TMB4 (trimedoxime or dipyroxime) and toxogonine from the bipyridinium oximes group.

As symptomatic measures to treat poisoning by nerve war gases one uses anticholinergic remedies which penetrate into the central nervous system; out of these, atropine is the one medicine selected for this. Along with oximes, atropine represents the fundamental therapy for nerve war gas poisoning, and this type of combined therapy is pretty much prevalent in all countries. In addition, we have today also autoinjectors with combinations of these medicines. Medical units of all armies provide for anticholinergic medicines for first aid, the difference being only in the combinations and types of oximes and other symptomatic remedies used. This way, the problem of providing means for first aid and treatment in nerve gas poisoning has been, in principle, resolved.

Besides the oximes and anticholinergic medicines, anticonvulsive drugs (benzodiazepines, short-action barbiturates) have been used for treatment of individual central disturbances, such as convulsions. There is no need to give neuroleptic drugs and barbiturates acting for a prolonged period of time.

Of great significance in the treatment of poisoned persons is respiratory resuscitation, either in the form of oxigonotherapy or by the application of various mechanical respirators, particularly in the more severe poisoning cases. Also successful have been various detoxification methods (extracorporal haemodialisys, haemo-perfusion).

Insofar as therapy of poisoning by psychochemical war gases of the BZ type is concerned, symptomatic measures and partially drugs from the pharmaceutical antagonist groups (ezerine, tacrine) are used.

First aid and treatment of persons poisoned by vesicants and by poisons for exhaustion has not undergone any change. In severe cases the symptomatic general or special medical care is provided.

ORGANIZATION OF HEALTH SERVICE AND ANTICHEMICAL WARFARE PROTECTION

The general national defense concept demands that medical protection of civilian population and military forces be provided in all areas and regions. On the other hand, the operating conditions in a war and the specific nature and scope of the assignments impart the additional requirement that medical service functionally and also structurally adapt itself to the needs and circumstances of war operations. Because of this, health protection in general national defense is organized at all levels of sociopolitical units, from provincial and city units to the federation, whereas health service charges its peaceful nature inasmuch as this is necessary, possible,

or expedient. Here the fundamental network of medical organizations of united workers is developed within the framework of the township, while the medical protection system is based on the medical region.

Medical region is an area which encompasses the territory of two or more townships and where all the elements of medical protection are provided autonomously, without the need for leaning on medical organizations of the united workers without this territory, except perhaps occasionally for certain types of highly special aid which can be provided interregionally.

The bigness of the medical region is determined by the particular socialist republic and socialist autonomous province. Considering that the entire worker organization of medical service is based on the peacetime structure, the wartime medical regions are likewise formed on the basis of regional units of the townships formed in peacetime.

In accordance with these principles, the medical region must have the following capabilities:

- those which provide for not only the general but also the complete specialist preventive medicine protection, including the measures for medical RBH protection,
- the capability to provide all kinds of emergency--polyclinical and clinical treatment,
- the capability of taking and preserving blood,
- the capability for production of galenicals;
- the capability for instructing paramedical units,
- those of medical supply.

Every medical region organizes medical protection within its region in the manner which most corresponds to local conditions, requirements, and capabilities, as well as the tasks presented by the broader

sociopolitical units, due to special requirements of the military units and the civilian population. The needs and other conditions of individual regions require that they be subdivided into subregions, wherein the general medicine level of medical protection and the most important elements of the specialist level are provided. Depending on the development stage and the capabilities of the particular region, the capacities for the corresponding profile of highly specialized aid are also provided, based on the plan for the broader sociopolitical entity, which can be drawn upon also by the neighboring regions which due to their particular stage of development cannot afford this type of capability (interregional base).

Preventive medicine protection is provided through installations for preventive medicine protection and other organizations of the united workers dealing with their health care. Preventive medicine protection and medical RBH protection at the general level is provided by medical stations, health care centers, and clinical centers. Hygienic-epidemiological stations may be formed within the composition of these united workers' health care organizations. Health care centers and clinical centers which have the hygienic-epidemiological service provide preventive medicine protection and clinical RBH protection at the specialization level, whereas clinics for health care protection provide such at the specialized and the highly specialized level.

The treatment of the injured and the sick is done by the emergency polyclinical dispensaries and hospitals, emergency health care, psychological and somatic rehabilitation and by the home treatment system. The most frequent form of hospital health care organizations of united workers are general hospitals. In addition to these, there are also specialized hospitals, and likewise health care stations and centers which may have field beds for hospitalization of the injured and the sick which they are capable of treating right there.

Health care protection during wartime, and in particular when there are many injured and sick persons, can be divided into four levels: sanitary self-protection, general medical, specialized, and highly specialized aid. Each of these levels is characterized by the corresponding degree of expertise in the clinical measures, and for each one of them there are the corresponding health care service personnel in the form of permanent or temporary health care organizations of united workers. Analogously to the division of health care protection into four levels, the health care service personnel is also divided into four echelons along the existing structure of the health care service, as adapted to wartime conditions and requirements, in a systematized way. This means that under wartime conditions the health protection does not always come about at one locality and in the same health care organizations of the united workers, since the levels of health care protection are separated from each other not only spatially (territorially) but also in time, but then proceed in certain sequence, i.e. stagewise, so that with spatial and timewise increased distance the level of health care protection also increases.

Within the scope of this systematic concept of health care protection and general national defense, the protection against chemical warfare agents is also provided, i.e. development of measures for clinical protection against chemical warfare and taking care of those poisoned by war gases.

Within the framework of protective measures - in addition to technological protection (use of private and collective protective measures) - there are carried out also a number of other medical protection measures such as: sanitary chemical reconnaissance and observation, discovery and identification of chemical agents in water, foods, biological material and sanitary material supplies, expertise

and estimation of the usability of contaminated water, food, and sanitary supplies and the approval of their usage, protection from contamination and decontamination of the injured, health care organizations of the united workers and sanitary supplies.

The taking care of the persons poisoned by war gases encompasses measures and procedures associated with aiding, transporting, evacuating and treating the injured persons; a particular difficulty hereby is presented by the sudden emergence of injured persons on a massive scale with the concomitant need to provide immediate help to the greatest number of the injured possible, and this under the conditions within a contaminated environment. The basic measures for taking care of the poisoned persons is to remove them from the scene and to decontaminate them, followed by the application of etiological, pathogenic, and symptomatic therapy.

Based on health care protection levels, the measures for medical chemical protection and the taking care of persons poisoned by war gases encompass the following:

The health care self-protection level: chemical investigation and observation under all war and battle conditions by each individual (soldiers, workers, citizens), use of personal and collective protection media, medical self-help measures and mutual aid measures, as well as self-decontamination and mutual decontamination measures.

General level: sanitary chemical investigations, detection of chemical agents by means of detectors, detection of war poisons in water, sampling for analysis, chemical decontamination and providing general medical aid to those poisoned by war gases.

Specialized level: detection and identification of chemical agents by means of laboratory analyses, qualified chemical investigations, control, and evaluation of the usability of water, food, and sanitary materiel (expert opinion), and qualified medical help to those poisoned.

Highly specialized level (besides the above-mentioned tasks of the specialized level): solution of complex problems arising in connection with the expert opinion of the water, food, and sanitary materiel, evaluation of the chemical situation and state of the territory, study of the problem, and formulation of instructions and measures.

The scope and the magnitude of the tasks associated with taking care of persons poisoned by chemical warfare agents under the conditions of sudden and instantaneous appearance of a large number of poisoned persons is quite likely to exceed the capabilities of the health care personnel strength and equipment available at the location of the attack, which is why special organization and measures are needed, such as would provide timely and effective saving of lives and health of those poisoned. This is why medical help is provided in the following stages:

At the first stage, i.e. at the very location where poisoning occurs, first aid is applied in the form of self-help and mutual aid on the part of the soldiers themselves, workers and citizens, as well as civil defense units, Red Cross, and united workers organization.

At the second stage is offered qualified medical help in the form of general medical help in permanent or temporary health care organizations of the united workers (health care stations, general medical help stations, health care centers).

At the third stage is offered the specialized and highly specialized help, as well as hospitalization of the poisoned persons in general and specialized hospitals.

In every situation, the large number of poisoned persons and their rapid and nonuniform flow into field health care organizations of the united workers will unavoidably result in rapid overfilling of their capacities and in paralysis of other hospital operations. Besides a

suitable work organization, the most convenient solution is the "profiling" of certain departments or hospitals solely for the treatment of persons poisoned by war gases, particularly due to the unique medical treatment of such poisoned persons, whose healing is specific, complex, and of long duration.

All united work coordinated health care organizations which provide help to persons poisoned by war gases and which hospitalize those who are poisoned must have trained personnel and considerable amounts of antidotes, drugs, and resuscitation means. In order to be able to be a match to the complex tasks of medical antichemical warfare protection and treatment of persons poisoned by war gases, medical health care service must be prepared for this in advance, both in structure, organization, personnelwise, and in regard to materiel. Among other things, these preparations encompass the following tasks:

- training of all health care personnel regarding toxicology of war gases, protection, as well as measures of all kinds of medical aid to persons poisoned by chemical warfare agents,
- training of the population regarding protection from war gases and giving first aid to poisoned persons,
- enhancing production and supplying of health care organizations of coordinated work by sanitary materiel and supplies to provide help to those poisoned by war gases as well as means for private and collective chemical protection,
- enabling of preventive and laboratory service for detection and identification of poisons in various media (water, food, items of general use),
- timely protection of coordinated health care organizations, their people, equipment, and sanitary materiel through plans for sanitary antichemical warfare protection, building of shelters, and preparing basements for protective work and procurement of protection

means.

Among these preparations, a distinguished role is reserved to medical toxicology centers.

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Summary

ACTUAL PROBLEMS OF TOXICOLOGY IN THE SYSTEM OF GENERAL PEOPLE'S DEFENCE

The presented paper deals with modern trends in development of chemical warfare agents. The toxicology, clinical and medical protection in poisoning by some principal lethal (nerve gases) and incapacitating (harassing and psychochemical) agents have been surveyed.

The main rules of organization of antichemical and health service of protection, in general, have been discussed in the light of a possible mass chemical attack.

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